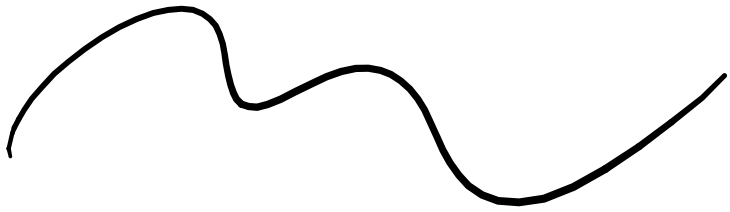
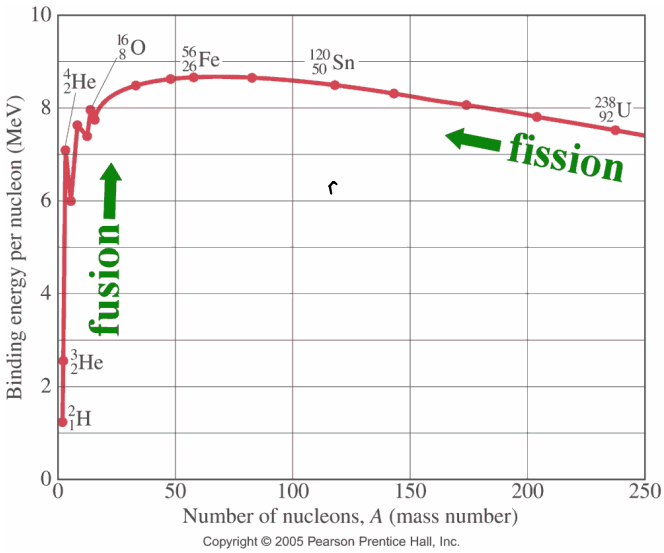
Wednesday, June 1, 2016 10:52 AM




Binding energy per nucleon (MeV)
Number of nucleons, A (mass number)
0
2
4
6
8
10
0
50
100
150
200
250
$^{2}_{1}$H
$^{3}_{2}$He
$^{4}_{2}$He
$^{16}_{8}$O
$^{56}_{26}$Fe
$^{120}_{50}$Sn
$^{238}_{92}$U
fusion
fission
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Test day vote:

June 6th : 1
june 8th: 12

Reactors and bombs - Relativity(not in book)
book check - hand back at final

Nuclear Reactors:
Fission reactor-
big nucleus breaks apart
eg. uranium 235, plutonium 239, thorium 232

are fissionable

uranium 238 is not fissionable and most natural uranium is 238
some reactors require that you enrich the uranium - get rid of some of the 238
difficult and expensive - separate by weight not chemical properties

CANDU reactor is Canadian designed and uses natural uranium and heavy water as a moderator.

moderator - substance that slows the neutrons to increase the rate of reaction.
heavy water - has deuterium instead of hydrogen
Chernobyl - reactor used graphite as a moderator - graphite is flammable
- meltdown in 1986

control rods: they absorb the neutrons, slowing the reactor. Often cadmium rods are used.

Fusion Reactors:
nucleus is positively charged, so fusion requires a large amount of kinetic energy for the particles to overcome the electrostatic repulsion. Therefore, very high temperatures (like over 1000K) is required. So magnetic containment is required but collecting the emitted energy is still difficult.

There are some fusion reactors in the world but they don't produce more usable energy than you

put in. Used for research into building a useful reactor.

building nuclear bombs:

Hiroshima bomb - gun type - shoot sub critical mass of uranium 235 into a uranium target, causing an uncontrolled chain reaction.

Nagasaki bomb - implosion - shell of plutonium 239 with explosives around it. When the shell collapses, the plutonium is supercritical and explodes.

Bikini Islands - tested a hydrogen bomb - implosion bomb surrounded by tritium. The fission reaction created enough energy to start a fusion reaction, making the energy released 10X greater.

Test June 8th ch 18,19,30,31

Relativity
Galileo - 1564-1642 - falling bodies falling at the same rate regardless of mass (no air resistance)
Earth goes around the sun- why don't you feel yourself moving?
Principle of relativity - all motion is relative.
Are you moving?
relative to the ground, no
relative to the sun, yes at 30 000m/s
depends on the frame of reference

eg. You are on a train moving at 20.0 m/s North relative to the ground.

If you walk towards the front of the train at 2.0m/s

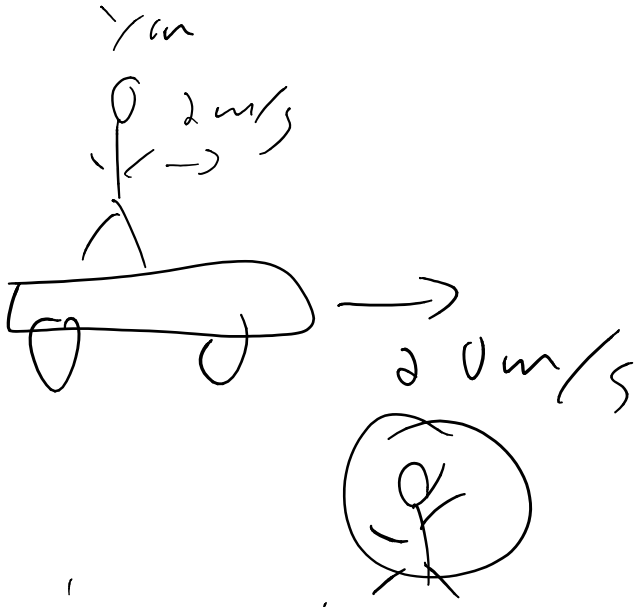
a) how fast are you moving relative to the ground?

b) how fast is the train moving relative to you?

c) how fast is a person watching the train moving in your frame of reference?

Relativity handout - q 1-5 p 110

a)



$V' = V + U$

V' is the velocity in the new frame of reference.

V is the velocity in the old frame of reference

U is the relative speed of the frames of reference.

e.g. $V = 2.0\,m/s$

$u = 20\ m/s$

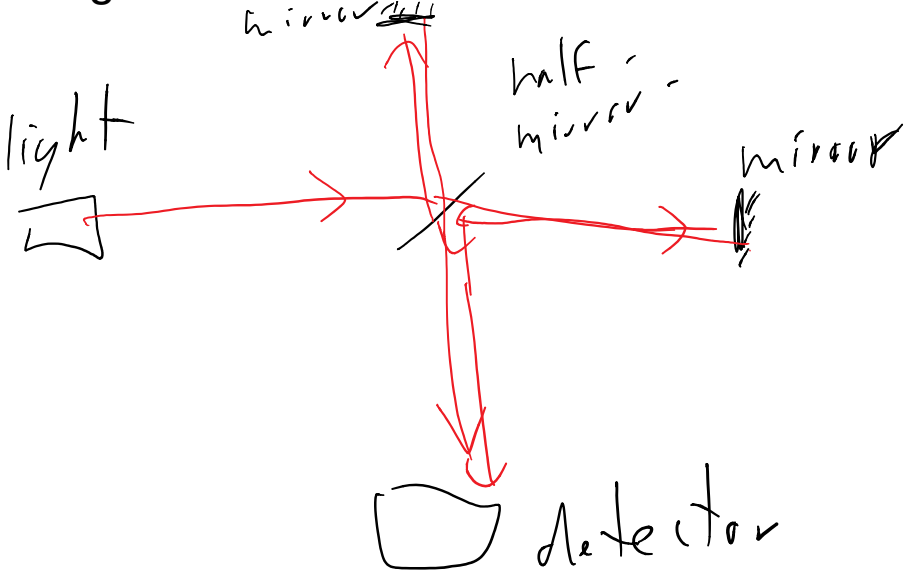
$V' = 20\ m/s + 2\ m/s = \boxed{22\ m/s}$

b) the train moves at 2 m/s in the other direction, 2 m/s South

c) 22 m/s South

Michelson - Morley experiment

trying to measure the motion of the Earth using a beam of light that is split in two directions. The interference of the waves of light indicate the motion of the earth.



result: there was no destructive interference no matter the orientation of the interferometer.

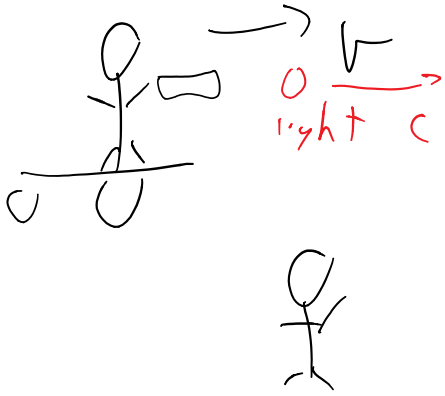
if you think about swimming, if you swim

upstream it is slower than downstream.

Light moved at the same rate regardless.

Einstein 1905 papers:
Theory of relativity:
postulated that

1. the speed of light is the same in all reference frames
2. the laws of physics are the same in all inertial (constant velocity) reference frames



both observers see the light moving at speed c, regardless of their speeds.
Wow! that is weird.
read the relativity handout
watch this movie
http://www.learner.org/vod/vod_window.html?pid=613